**Example 3.J:** Excess burden *formula under linear model & Tax-Revenue-maxizing tax rate*

Demand: $p^d = a - bQ^d \quad ; \; a \geq 0, \quad b \leq 0.$

Supply : $p^s = c + dQ^s \quad ; \; d \geq 0.$

- Solve for quantity and prices equilibrium when the unit tax is imposed. Analyze the result

$Q_E$ ; $p^d = p^s$

$a - bQ = c + dQ$

$a - c = bQ + dQ$

$Q_E = \frac{a-c}{b+d}$

$P_E = c + d\left(\frac{a-c}{b+d}\right)$

New supply ; $p = c + dQ + t$

$a - bQ = c + dQ + t$

$a - c - t = bQ + dQ$

$Q_{tax} = \frac{a-c-t}{b+d}$

$P_{tax} = a + d\left(\frac{a-c-t}{b+d}\right)$

- Derive the excess burden formula for buyers and sellers

Excess burden formula; ($\frac{1}{2} \times$ base $\times$ high)

$$= \frac{1}{2} \times \left[ \left( a - b\left( \frac{a-c-t}{b+d} \right) \right) \right] - \left[ c + d \frac{(a-c-t)}{b+d} \right] \left( \frac{a-c}{b+d} - \frac{a-c-t}{b+d} \right)$$

- Calculate the tax rate that maximizes the tax revenue of government.

Tax revenue = $t_{\text{per unit}} \times Q_{tax}$

$$= t \times \frac{a-c-t}{b+d}$$

Max. Tax revenue = $a - b\left(\frac{a-c-t}{b+d}\right) - cd\left(\frac{a-c-t}{b+d}\right)$